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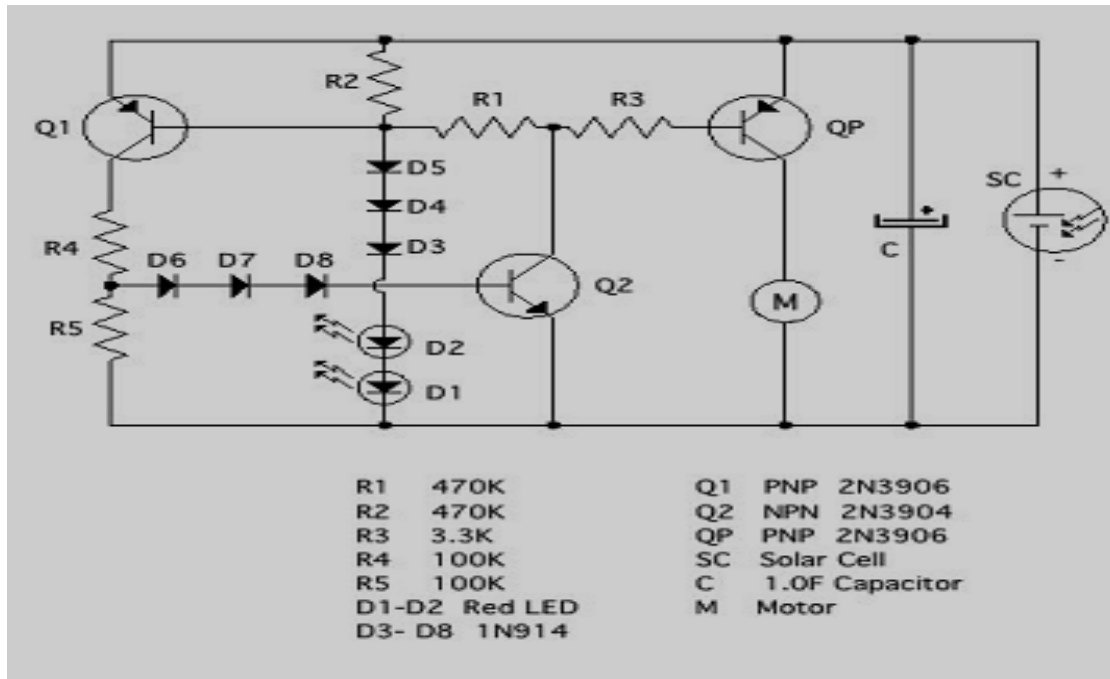
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Solar Powered School Bus

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Emeritus professor of mathematics



A promising motor and gearbox was picked out of the jumble under the bench. Some tinkering with makeshift setups indicated that the motor set up with an 18:1 gear ratio would give the toy a good speed, but it would need at least 3.5V to move assuredly.. A table shown there lists some of the common combinations and their switching voltage. In this case, the cycle voltage on and off points had to be higher than previously tried. Experimentation on a solder less breadboard finally resulted in the satisfactory combination shown here. The string that triggers the base of transistor Q1 to ground has two red LEDs and three diodes in series. It turns on at about 4.1V. The latch transistor Q2 has three diodes in series with its base giving a turn-off point of around 3.6V. This arrangement yields good lively performance for the bus



The solar engine circuit

After setting up and testing the circuit on a solder less breadboard, the components were transferred to a small "experimenter" board and soldered up. Such universal boards are available from several electronics parts suppliers.

This particular toy bus had a large open area on top, so that children could put play school passengers inside! A panel was cut from thin plywood to fit this opening which was perfect for mounting the solar cells.

To satisfactorily operate a solar engine that has a turn-on voltage of 4.1V, the cells themselves, or in series, should be capable of an open circuit voltage output of 4.6 or 5V in the lowest lighting conditions under which you will want the bus to operate. The cells used by the author are the thin film on glass type which yield good voltage under indirect sun or indoor artificial lighting. Some crystalline cells have satisfactory voltage under indirect sunlight, and very good current in sunny conditions.

A particularly good indoor type cell is that used in some solar keychain flashlights, like the one shown in the photo below. The cell is easily removed and its voltage is very good - about 7V in the sun and 5.5V under an overhead florescent . About 6 of them would fit on the top of this school bus, and connected in parallel should have a good total output current, even in shaded areas.

As always, the best procedure is to breadboard your circuit, hook up a motor and solar cells, and observe its performance over a week or so. When you have the right working combination, start going to garage sales looking for a bus!

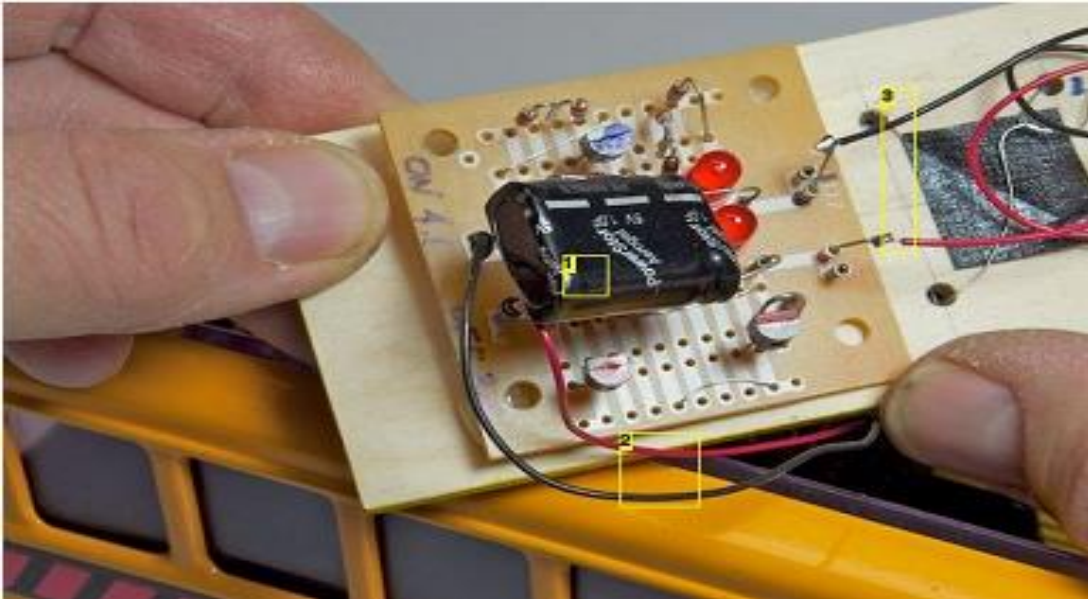


Image notes—

1. 1.0 Farad super capacitor
2. Long leads to motor.
3. Leads from the solar cells

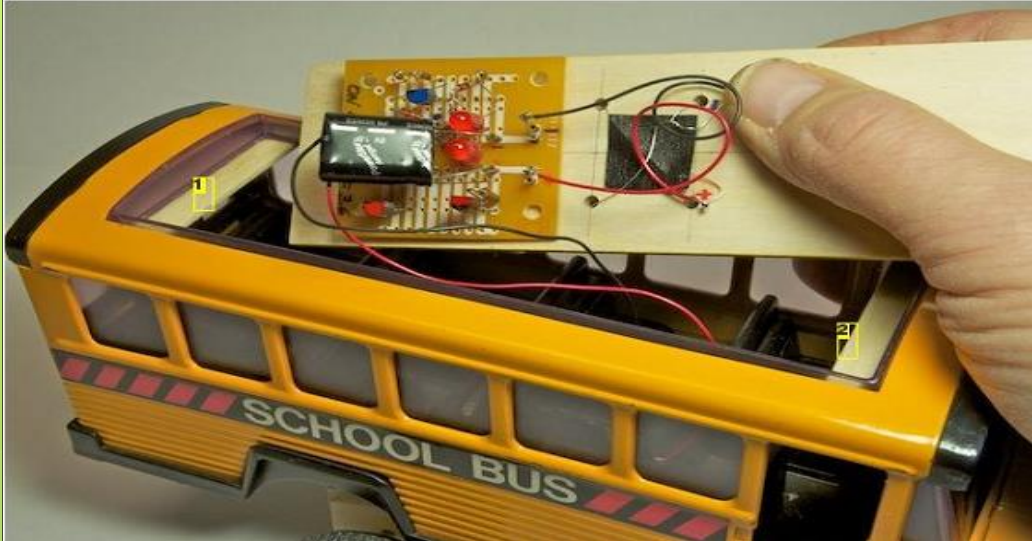


Image notes—

1. Wood strip to support roof panel
2. Wood strip to support roof panel

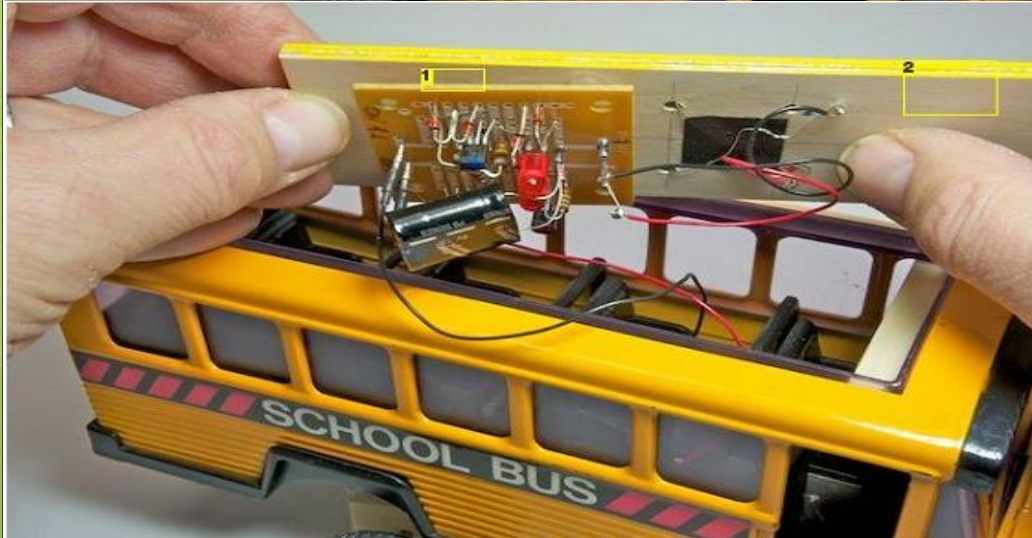


Image notes—

1. The circuit board is mounted to the underside of the roof panel with glue dots.
2. Thin plywood roof panel



Image notes—

1. These solar cells work well in indirect and indoor lighting, as well as in strong sunlight.
2. The roof panel fits inside the open top of the school bus and rests upon the supports at each end.
3. Wood strip to support roof panel at each end.



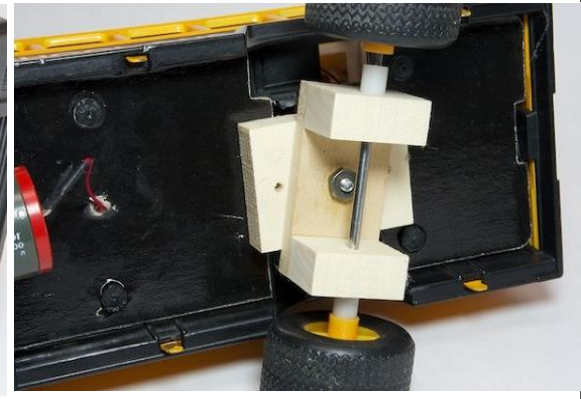
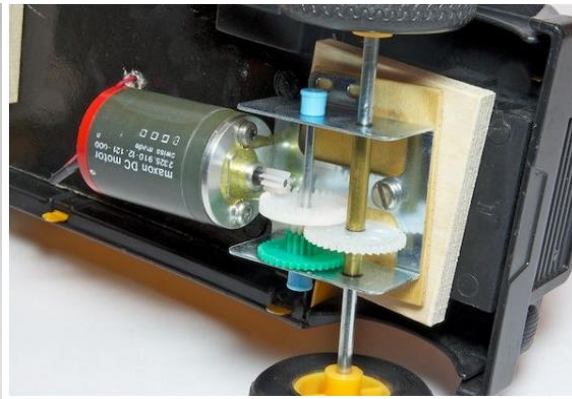
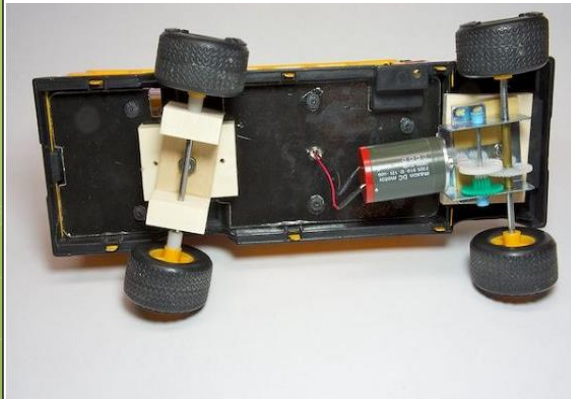
Image notes—

1. A good source for solar cells that work well in room light are key chain flashlights like this one.

These views show the mechanical details on the underside of the bus. Both axles are mounted so that they can be angled to make the bus run in a circular path. I usually have them set so that the bus will run in a pretty tight circle - only a couple of feet in diameter. That way we still have room for some furniture in the living room! The front axle is the powered one which gives better curve following ability. The body is "raised" a good bit to allow the wheels to clear the body when set for a such small circular path.

The motor used here is a high efficiency type found at a factory surplus sale. Ordinary toy motors take too much start up current to work well with solar engines. Look for a motor intended for operation on solar cells or one with around 10 Ohms static resistance. The Easter Solar Engine Instructable has some more information on suitable motors for this kind of application.

Finally, not shown in these photos, a yellow LED blinker has been added to the top of the bus to warn us where it has parked itself for the night. The blinker operates from the low power CSS555 timer circuit described in the Electronic Paperweight Instructable and flashes all night long from a separate 1 Farad capacitor charged from the main solar cells.



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